

Application Serial No.: 10/623,243
Attorney Docket No.: 0140111

REMARKS

Reconsideration and allowance of pending claims 1, 3-16 and 18-20 in view of the following remarks are respectfully requested. At the outset, Applicants note that a good and sufficient reason why the present response is necessary and was not earlier presented is that an entirely new reference has been cited in the present final rejection dated April 6, 2005. *See* 37 CFR §1.116(c). The new reference is U.S. Patent Application Publication Number 2003/0104657 to Kinsman et al. ("Kinsman") which is for the first time brought to Applicants' attention by means of the present *final rejection* dated April 6, 2005. The new reference, i.e. Kinsman, was not cited in the present application prior to the instant final rejection. Since Kinsman is a reference upon which the Examiner has now relied, Applicants believe that it would be manifestly unfair for the Patent Office not to consider Applicants' arguments which are necessitated due to the newly cited reference, Kinsman. As such, a good and sufficient reason exists, as required by 37 CFR §1.116(c), for considering Applicants' present response and withdrawing the finality of the present Office Action.

A. Rejections of Claims 1, 3-16 and 18-20 under 35 USC §103(a)

The Examiner has rejected claims 1, 3-16 and 18-20 under 35 USC §103(a) as being unpatentable over U.S. Patent Number 6,338,985 to Greenwood (hereinafter, "Greenwood") in view of U.S. Patent Application Publication Number 2003/0104657 to Kinsman et al. ("Kinsman"). For the reasons discussed below, Applicants respectfully

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submit that the present invention, as defined by independent claims 1, 9, and 16, is patentably distinguishable over Greenwood and Kinsman, either singly or in combination.

As disclosed in the present application, conventional multi-chip module or multi-component module (MCM) fabrication processes may reduce the reliability of particular surface mount components included in an MCM and thus reduce the reliability of the overmolded MCM itself. The present invention as defined by independent claims 1, 9 and 16 overcomes this reduction in reliability in overmolded MCMs brought forth by conventional MCM fabrication processes.

The present invention, as defined by independent claims 1, 9 and 16, includes a surface mount component (also referred to as "SMC"), having first and second terminals, and which is situated over a substrate. First and second pads are situated on the substrate and are coupled to the first and second terminals, respectively. As part of the solution to the shortcomings of the conventional technology, solder mask trench 124 (seen in Figure 1) is formed under a SMC, such as SMC 102 or SMC 302. More importantly, solder mask trench 124 is formed where, in the absence of the present invention, no solder mask opening would be formed.

Referring to Figure 1, by forming solder mask trench 124 underneath the SMC and within solder mask 112, moldable gap 125, with an increased height 128, is advantageously formed and is substantially larger than a conventional moldable gap. By contrast, in a conventional structure, solder mask 112 would fill the region between pads 106 and 108 underneath the SMC. As a result, a conventional moldable gap that would

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be formed between solder mask 112 and the bottom surface of the SMC would have a reduced height 130, as shown in Figure 1 of the present application.

Thus, by forming solder mask 124 within, i.e. between portions of, solder mask 112, embodiments according to the present invention advantageously achieve a significantly larger moldable gap, having height 128, that improves molding compound flow underneath the SMC and, consequently, minimizes void formation underneath the SMC. As a result, embodiments according to the present invention advantageously minimize the risk of shorting between the terminals of the SMC during, for example, reflow assembly. Indeed, since the invention does not require complex changes to the existing technology, the disadvantages of the existing technology in having voids in molding compounds under an SMC are overcome without significantly increasing manufacturing costs. Thus, among other advantages, the reliability of the SMC and the overmolded MCM itself can be significantly increased in an economic manner.

In contrast, Greenwood provides a method for making chip size semiconductor packages wherein one or more vent openings through the substrate and solder mask can be used to displace the air in the gaps trapped between the die and the substrate and solder mask as underfill material is injected into the package assemblies. As acknowledged by the Examiner, however, Greenwood does not disclose that the solder mask trench is situated over a top surface of the substrate as defined by independent claims 1, 9 and 16.

For the reasons that follow, Applicants submit that Kinsman does not suggest use of a solder mask for accommodating or creating a trench in the solder mask and over a

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top surface of a substrate underneath an SMC, as disclosed and claimed by the present invention. As such, Kinsman cannot be combined with Greenwood to achieve the present invention. More particularly, Kinsman involves a transfer mold semiconductor packaging process which provides a circuit substrate having a solder mask and a semiconductor chip mounted to a side of the circuit substrate, such that the semiconductor chip can be received by a void in a transfer mold. See, for example, Kinsman, paragraph 0008. As such, the problem addressed by the disclosure in Kinsman is separate and distinct from the problem addressed by the present invention as defined by independent claims 1, 9 and 16. For example, Kinsman explains that clamping forces applied by the mold body to a substrate can be quite high and that these high clamping forces introduce high shear forces in the solder mask, which can cause severe cracking of the solder mask. See, for example, Kinsman, paragraph 0006. Thus, the disclosure in Kinsman is directed to avoiding the cracking of the solder mask at the mold void perimeter by providing stress relief to the solder mask at the mold void perimeter, whereas the present invention is directed to improving molding compound flow underneath a SMC.

Moreover, referring to Figure 3, Kinsman discloses the use of an elongated trench 35 in solder mask 25 that “is continuous about a *periphery* defined by the radial outermost portions of elongated trench 35.” See Kinsman, paragraph 0024 (emphasis added). Furthermore, as seen in Figure 4 of Kinsman, “transfer mold 50 is positioned to align at least a portion of void perimeter 56 over at least a portion of solder mask peripheral trench 35” (see Kinsman, paragraph 0026) so as to not only relieve stress on the solder

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mask at the mold void perimeter, but also to allow encapsulant materials to better adhere to the circuit substrate. See for example, Kinsman, paragraph 0029.

Consequently, the disclosure in Kinsman does not suggest a combination with Greenwood for any purpose, and in fact Kinsman teaches away from using a solder mask trench *underneath* a SMC to improve molding compound flow underneath the SMC as defined by independent claims 1, 9 and 16, because the trench used in Kinsman is limited to a periphery that is to align with a mold void perimeter in an effort to relieve stress and to possibly allow encapsulant materials to better adhere to the circuit substrate.

Therefore, there is no suggestion to combine Greenwood and Kinsman and, even if combined, such purported combination would not achieve the present invention.

For the foregoing reasons, Applicants respectfully submit that the present invention as defined by independent claims 1, 9, and 16, is not taught, disclosed, or suggested by the art of record. As such, the claims depending from independent claims 1, 9, and 16 are, *a fortiori*, also patentable for at least the reasons presented above and also for additional limitations contained in each dependent claim.

B. Conclusion

Based on the foregoing reasons, the present invention, as defined by independent claims 1, 9, and 16, and the claims depending therefrom, is patentably distinguishable over the cited art. Thus, outstanding claims 1, 3-16 and 18-20 are patentably distinguishable over the cited art. As such, and for all the foregoing reasons, the

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withdrawal of the finality of the present rejection and an early allowance of all claims 1,
3-16 and 18-20 remaining in the present application are respectfully requested.

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Respectfully Submitted,
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